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P01/7700 0.00-0208568.6

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Request for grant of a patent

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1.	Your reference	P2842-GB
2.	Patent application number *(The Patent Office will fill in this part)*	0208568.6
3.	Full name, address and postcode of the or of each applicant *(underline all surnames)*	Tyco Electronics Raychem N.V. Diestsesteenweg 692 B-3010 Kessel –10 Belgium
	Patents ADP number *(if you know it)*	83607110001
	If the applicant is a corporate body, give the country/state of its incorporation	
4.	Title of the invention	OPTICAL CIRCUIT ENCLOSURE
5.	Name of your agent *(if you have one)*	SHELLEY, Mark Raymond
	"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*	K R Bryer & Co 7 Gay Street Bath BA1 2PH
	Patents ADP number *(if you know it)*	10777002

6.	If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number	Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7.	If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application	Number of earlier application	Date of filing *(day / month / year)*

8.	Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:* *a) any applicant named in part 3 is not an inventor, or* *b) there is an inventor who is not named as an applicant, or* *c) any named applicant is a corporate body.* *See note (d))*	YES

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9.– Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	
Description	12
Claim(s)	3
Abstract	1
Drawing(s)	3

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Priority documents	
Translation of priority documents	
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	ONE
Request for substantive examination *(Patents Form 10/77)*	
Any other documents *(please specify)*	

11. I/We request the grant of a patent on the basis of this application.

Signature

Date 12.04.02

12. Name and daytime telephone number of person to contact in the United Kingdom

M R Shelley
(01225) 428877

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OPTICAL CIRCUIT ENCLOSURE

This invention concerns an optical circuit enclosure and in particular an enclosure for pre-fabricated pre-installed optical circuits or optical circuit components.

Fibre optic circuits may contain splitters, filters, attenuators and other components, each of which is normally provided with optical fibres for connecting these components to other components. Optical components can be connected by splicing the ends of the fibre protruding from the components to be joined. For permanent connections it is normally preferred to splice the fibres using a suitable splicing device, however, it is also possible to connect fibres using suitable connectors. In order to facilitate the connection of optical components to a fibre optic network such as a telecommunications network it is usually convenient to mount the optical components to be connected within a so-called "organiser tray" which comprises a tray like structure having various component holders, splice holders and/or optic fibre storage regions located within a thermoplastic closure. This arrangement facilitates field installation of optical components since a high degree of component and fibre organisation can be achieved with the organiser tray.

Closures having an organiser tray with a storage compartment on the underside of the tray are known. However, known closure and organiser tray arrangements have a number of drawbacks particularly where it is desirable to install expensive and/or delicate optical components since great care must be taken not to damage such components when access to the organiser tray is required for field installations of the

optical components within the closure. The optical components may be damaged during manipulation of the organiser tray and additionally or alternatively by water or moisture ingress or by other environmental effects.

There is a requirement therefore for an optical circuit enclosure for both sensitive (and/or expensive) and less sensitive (and/or expensive) optical components that can be readily installed in an optical circuit or network under field conditions with the minimum risk of damage to the more delicate or environmentally sensitive optical components to be installed.

There is also a requirement for an enclosure where pre-fabricated factory installed optical components are protected from environmental and installation damage when the optical components are being connected to other optical components in the field.

According to aspects of the invention there is an optical circuit enclosure enclosing at least one optical circuit or optical circuit component; the said enclosure comprising:

an open ended box or tray type container containing at least one optical circuit or optical circuit component;

a tray type closure member closing the said container; the closure member containing at least one further optical circuit component on an external side thereof for optically connecting the said enclosed component to an external optical circuits; and

sealing means providing a moisture resistant seal between the said container and the said closure member.

The above aspect of the invention readily enables delicate and/or expensive optical circuits or components thereof to be enclosed within the container and protected from environmental damage and/or damage due to handling, storage, transport and installation. The sealing means readily prevents liquid or vapour ingress to the enclosed container to protect the component or components therein. The further optical components on the external side of the tray type closure member readily permit the enclosed component or components to be optically connected to an external optical circuit or network. In this way it is possible to connect the enclosed component or components without physically accessing the component within the enclosed container.

Preferably, the said sealing means comprises a laminar sheet intermediate the said container and the said closure member. In such an embodiment the laminar sheet can enclose the container in such a way that the closure member protects the laminar sheet as well as the optical component or components contained within the container. In this way a relatively thin sheet can be interposed between the container and closure member so that a moisture resistant seal is formed independently of the closure member material. In other embodiments the sealing means may be further provided by the interengaging surfaces of the container and closure member when formed of suitable material, for example aluminium or other metals.

In preferred embodiments, the said laminar sheet comprises a metallised moisture resistant layer. Preferably, the metallised layer comprise an aluminium laminate.

Preferably, the said sealing means provides a moisture resistant seal between the said container, the said closure member and fibre optic connecting cables exiting the enclosed region of the container from the enclosed component. This readily enables optic fibre or fibres to pass through the seal into the enclosed region of the container without affecting the performance of the seal. This is an important consideration since the optic fibres are necessary for connecting the enclosed component or components to external circuits.

In one preferred embodiment, the said sealing means comprises a pair of sealing members and the said optical fibres are located between the said strips and sealed to the strips by the application of heat and/or pressure. By accommodating the optic fibres between the sealing strips heat and/or pressure or both can be readily applied causing the sealing strips to change shape and surround the fibres. This is particularly advantageous when the sealing strips are made of plastic which may melt slightly, resulting in a good mutual bond and a good bonding with the fibres.

Preferably, the said closure member is attachably/detachably mounted with respect to the said container. This readily enables the closure member to be removed to provide access to the interior region of the container so that the optical components contained therein may be removed replaced or repaired or for the installation of a further component or components.

In preferred embodiments, the said enclosed circuit or component is a pre-installed

and/or pre-fabricated circuit or component installed in the said container during manufacturing assembly thereof. This is particularly advantageous where it is required to seal pre-fabricated components or circuits within the container during manufacturing assembly so that installation of the prefabricated circuit or components comprising the circuit can be automated.

In preferred embodiments the said closure member closes each of the said containers, thereby to provide separate enclosures for respective optical circuits and/or components. One or more fibre splices may be mounted in a splice holder mounted on the external surface of the closure for connecting these components or the enclosed component or components to an external circuit or network. The external surface of the closure member may further contain spare lengths of fibre for field installation etc. Components such as couplers and splitters are generally quite robust and therefore may be readily mounted on the external side of the closure member without significant risk of damage during installation to an external network or circuit.

In preferred embodiments, the enclosure further comprises at least one further container and wherein the said closure member closes each of the said containers, thereby to provide separate enclosures for respective optical circuits and/or components. This readily enables a single closure member to be used in combination with a plurality of containers so that a plurality of enclosure are formed on one side of the closure member opposite that of the external side containing the further components. This is particularly advantageous in embodiments where two or more expensive or sensitive optical components or circuits are required to be separated

from each other and the other components on the opposite side of the closure member.

According to a further aspect of the invention there is an optical circuit enclosure enclosing at least one optical circuit or optical circuit component the said enclosure comprising:

an open ended box or tray type container containing at least one prefabricated pre-installed optical circuit component therein;

a tray closure member closing the said container; the closure member containing at least one further optical circuit component on an external side thereof for optically connecting the said enclosed component to an external optical circuit.

In this aspect of the invention the container is specifically designed for factory installation of pre-fabricated optical circuits and components during manufacturing assembly. The closure member protects the circuits and/or components located in the container and further provides an organiser type tray for storing other components on the opposite external side thereof, including for example spare lengths of fibre and fibre splices for connecting the components to an external network or circuit. This arrangement is particularly advantageous for field installation since sensitive and/or expensive pre-fabricated factory installed components and circuits can be located securely within the enclosed container while other less sensitive components can be conveniently positioned on the external side of the closure member for field installation.

Various embodiments of the invention will now be more particularly described, by way of an example, with reference to the accompanying drawings, in which:

Figure 1a is an exploded perspective view of an optical circuit enclosure according to an arrangement of the invention;

Figure 1b is a perspective view of the assembled enclosure shown in Figure 1a;

Figure 2a is an exploded perspective view similar to that of 1a, but with an optical circuit enclosure according to a further arrangement of the invention;

Figure 2b is a perspective view of the assembled enclosure of Figure 2a; and

Figure 3 is an exploded perspective view of the enclosure of Figure 2a with a different type of prefabricated circuit to be enclosed to that shown in Figure 2a.

Referring to Figure 1a, an optical circuit enclosure 10 comprises a rectangular shaped open ended box type container in the form of a shallow rectangular tray type structure having a flat rim 14 surrounding a hollow interior region 16 of the tray. The size and shape of the hollow region 16 is sufficient to accommodate components of a pre-fabricated or pre-assembled optical circuit 18, for example. Various types of optical circuit may be located in the region 16 of the container and may be mounted with respect to the container by various mounting means, for example by snap-fit connections or adhesive etc. In the embodiment of Figure 1a it is preferred, although not essential, that the optical circuit components 18 are mounted within the region 16 during manufacturing assembly of the enclosure 10.

The enclosure further comprises a closure member 20 which also may be considered

to comprise a rectangular tray type structure having a flat rectangular base 22 and upstanding wall sections 24 which form a non-continuous wall on the external surface (upper surface in the drawing of Figures 1a and 1b) of the closure member. The reverse surface (not shown) on the opposite side of the closure member is flat so that a moisture resistant seal can be formed between the closure member and the rim 14 of the container 12.

The moisture resistant seal is provided by a thin laminar sheet 26 interposed between the container and closure member. The laminar sheet 26 preferably comprises an aluminium layer to enhance the moisture resistant properties of the seal. The dimensions of the sheet are approximately the same as the dimensions of the container and closure member so that that a seal is formed continuously around the periphery of the enclosure along the flat rim surface 14 of the container.

The container and closure member materials are also moisture resistant and may comprise aluminium, alloys of aluminium or other metals. In other embodiments the container and enclosure member may comprise moisture resistant polymers, for example.

The external surface of the closure member is provided with various features for mounting or holding further optical circuit components, for instance splitters, couplers, filters, attenuators, and free or uncut lengths of optic fibre or fibre ends. In this respect the enclosure of the present invention contemplates that delicate, sensitive and/or expensive optical components will be installed as prefabricated circuits or

otherwise in the enclosed region 16 so that they are fully protected from environmental damage and/or damage caused during installation of the optical circuit in an external circuit or network, while more robust components are mounted on the external surface of the enclosure member so that the closure member constitutes a conventional organiser tray.

In the arrangements of Figure 1a, the external surface of the closure member 20 includes a pair of upstanding wall elements 28 for mounting optic fibre splice holders (not shown) and open regions 30 for storing spare lengths of fibre.

In Figure 1b the components of the enclosure 10 are shown in their assembled condition. Although not shown in the drawing of Figure 1b the enclosed components are connected to fibres which pass through the seal for connecting these components to other components as desired. It is preferred that the fibres are accommodated between two sealing strips (not shown) so that they are not is direct contact with either the container 12 or closure 20 when they pass through the seal 26. By providing a pair of sealing members in the region of the seal 26 for sealing the fibres, the strips can be sealed around the fibres by the application of heat an/or pressure. This sealing of the fibres may be achieved by the optical fibre sealing method described in GB patent application no. 0110366.2 which will be discussed in more detail below.

Referring now to Figure 2a, in a second arrangement the enclosure 10 comprises a container 12 and an enclosure member 20 of slightly different proportions to that of Figure 1a and 1b. In this arrangement the laminar sheet 26 has been removed and the

base portion 22 of the closure member comprises a series of apertures 32 so that the enclosed region on the underside of the closure member 20 is not sealed with respect to the upper or external side thereof. In the arrangement shown the enclosure is sufficiently long to accommodate two prefabricated optical circuits 18 in a side-by-side arrangement within the container. The optical circuits 18 are similar although not identical to each other but are prefabricated in the same way for factory installation within the container 12 in the same way that the circuit 18 of Figure 1a is.

The optical circuits 18 are prefabricated in accordance with the method described in GB patent application no. 0129906.4. This method of assembling a fibre optic circuit comprises the steps of providing fibre optic components connected to optical fibres having fibre ends, arranging the fibre optic components on a support 34, routing the fibre ends in accordance with a predetermined circuit configuration, and splicing and/or connecting the fibre ends so as to complete the circuit. In this method a plurality of fibre ends are spliced simultaneously and supported in a splice holder 36.

These prefabricated pre-assembled optical circuits 18 are mounted within correspondingly shaped recesses 38 provided in the internal surface of the container 12. The support members 34 may be connected to the container surface by adhesive, snap-fit connections or other mounting means during factory installation of the circuits during manufacturing assembly.

The components of Figure 2a are shown in the assembled condition in the drawing of Figure 2b.

Referring to Figure 3, the enclosure 10 is identical to that shown in Figure 2a but in this drawing the optical circuit or components 18 are hermatically sealed within a moisture resistant envelope 40 before being mounted in the internal region 16 of the container. In this arrangement the electronic components or circuit 18 are hermatically sealed such that the fibre ends 42 connected to the components being sealed extend outwards of the seal for connection to other components. This method of sealing optical components may be as is described in GB patent application 0110366.2 which describes a method of sealing the enclosing space into which at least one optical fibre is fed. This method comprises the steps of: providing a container having an opening, providing two sealing strips, accommodating a portion of at least one optical fibre between the two sealing strips, applying heat and/or pressure to the strips to as to produce a sealing member which sealing encloses the at least one fibre, placing the sealing member in the opening and applying heat and/or pressure to the container so as to seal the opening on to the strips. In this method it is preferred that the container is constituted by a bag made of laminate comprising aluminium and that the sealing strips are made of plastic and are provided with a layer of hot melt adhesive.

In the arrangements of Figures 2a and 3 the fibres ends may be connected to components on the external side of the closure 20 by passing through one or more of the apertures 32 formed in the base portion 22 of the closure. This provides the advantage that delicate, sensitive and/or expensive optical components or circuits may be enclosed in the region 16 during manufacturing assembly and thereby protected by

the closure 20 from damage during installation of the circuit or components to an external circuit or network. This provides for additional automation of the manufacturing assembly process since only those components that access is required to need to be mounted on the external side of the closure or tray organiser 20.

Although the invention has been described with reference to embodiments shown in the accompanying drawings it is to be understood that the invention is not so limited to those precise embodiments and that various changes and modifications may be affected without further inventive skill and effort. For example, the seal between the container and closure member in the arrangement of Figure 1a may be replaced by a gasket or o-ring type seal or other sealing means if required.

CLAIMS

1. An optical circuit enclosure enclosing at least one optical circuit or optical circuit component; the said enclosure comprising:

an open ended box or tray type container containing at least one optical circuit or optical circuit component;

a tray type closure member closing the said container; the closure member containing at least one further optical circuit component on an external side thereof for optically connecting the said enclosed component to an external optical circuits; and

sealing means providing a moisture resistant seal between the said container and the said closure member.

2. An optical circuit enclosure as claimed in Claim 1 wherein the said sealing means comprises a laminar sheet intermediate the said container and the said closure member.

3. An optical circuit enclosure as claimed in Claim 2 wherein the said laminar sheet comprises a metalised moisture resistant layer.

4. An optical circuit enclosure as claimed in any one of Claims 1 to 3 wherein the said sealing means provides a moisture resistant seal between the said container, the said closure member and fibre optic connecting cables exiting the enclosed region

of the container from the enclosed component.

5. An optical circuit enclosure as claimed in Claim 4 wherein the said sealing means comprises a pair of sealing members and the said optical fibres are located between the said strips and sealed to the strips by the application of heat and/or pressure.

6. An optical circuit enclosure as claimed in any preceding claim wherein the said closure member is attachably/detachably mounted with respect to the said container.

7. An optical circuit enclosure as claimed in any preceding claim wherein the said enclosed circuit or component is a pre-installed and/or pre-fabricated circuit or component installed in the said container during manufacturing assembly thereof.

8. An optical circuit enclosure as claimed in any preceding claim wherein the said at least one further optical circuit or component comprises an optical splitter, coupler attenuator or filter and/or fibre optic cable.

9. An optical circuit enclosure as claimed in any preceding claim comprising at least one further container and wherein the said closure member closes each of the said containers, thereby to provide separate enclosures for respective optical circuits and/or components.

10. An optical circuit enclosure enclosing at least one optical circuit or optical circuit component the said enclosure comprising:

an open ended box or tray type container containing at least one prefabricated pre-installed optical circuit component therein;

a tray closure member closing the said container; the closure member containing at least one further optical circuit component on an external side thereof for optically connecting the said enclosed component to an external optical circuit;

ABSTRACT

OPTICAL CIRCUIT ENCLOSURE

In one aspect the invention provides an optical circuit enclosure (10) enclosing at least one optical circuit or optical circuit component; the enclosure comprises: an open ended box (12) or tray type container containing at least one optical circuit or optical circuit component (18); a tray type closure member (20) closing the container; the closure member containing at least one further optical circuit component on an external side thereof for optically connecting the enclosed component to an external optical circuits; and sealing means (26) providing a moisture resistant seal between the container and the closure member.

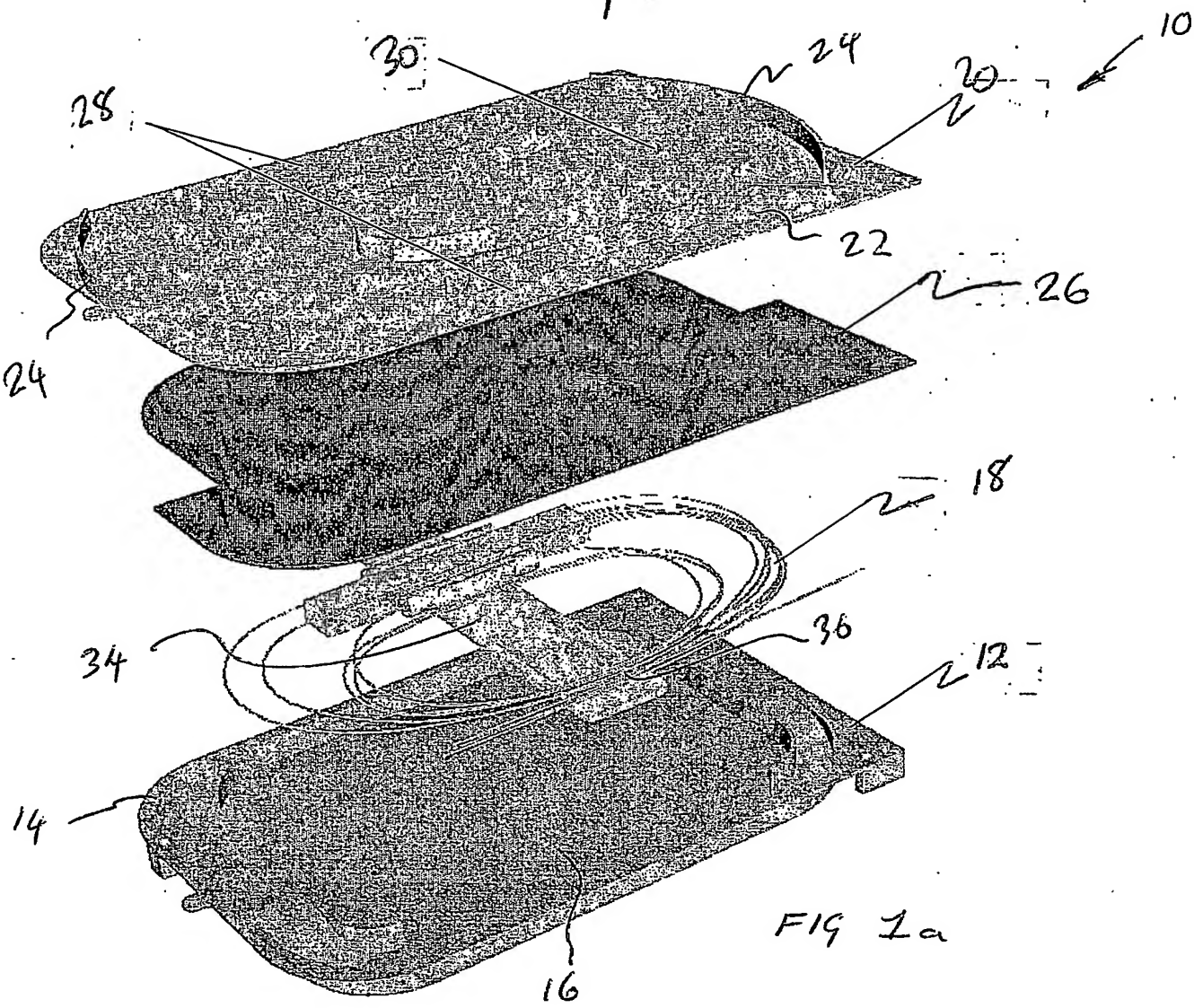

FIG 1a

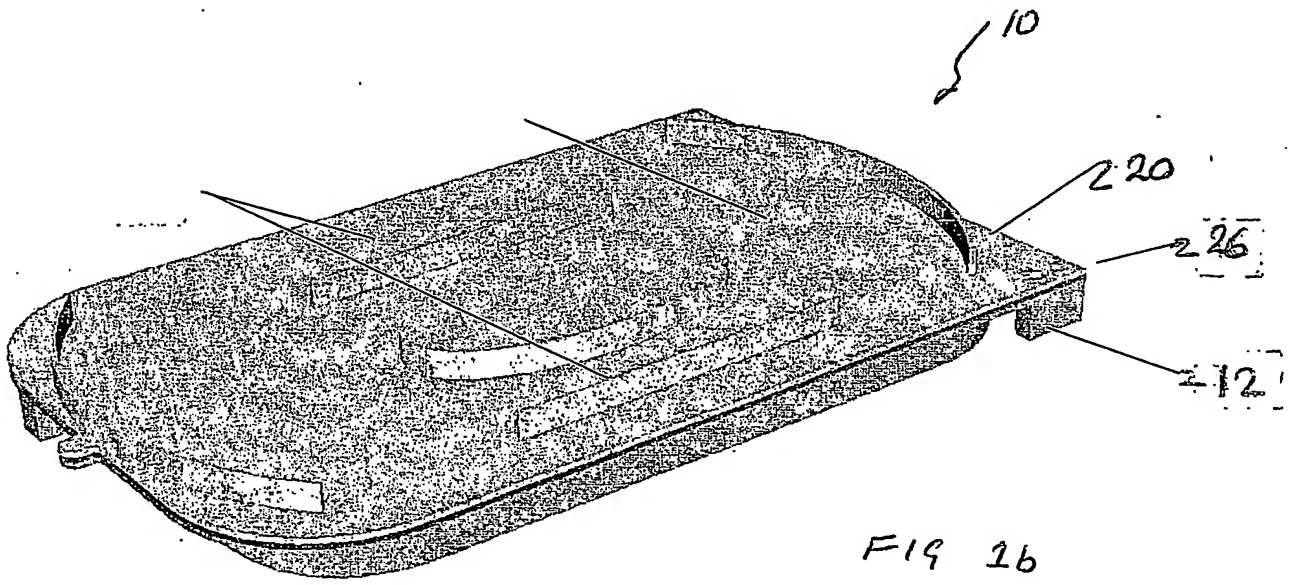

FIG 1b

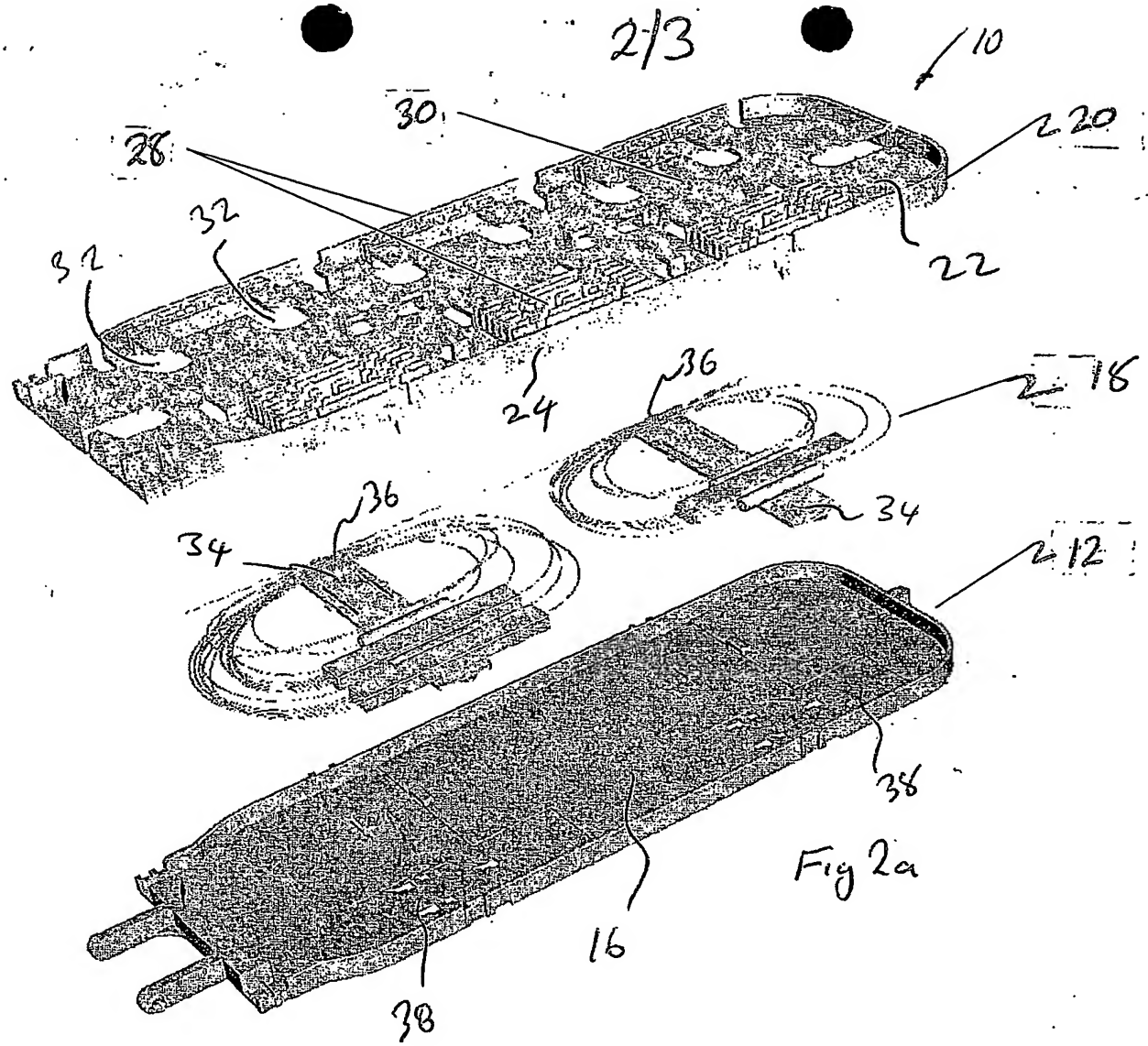

Fig 2a

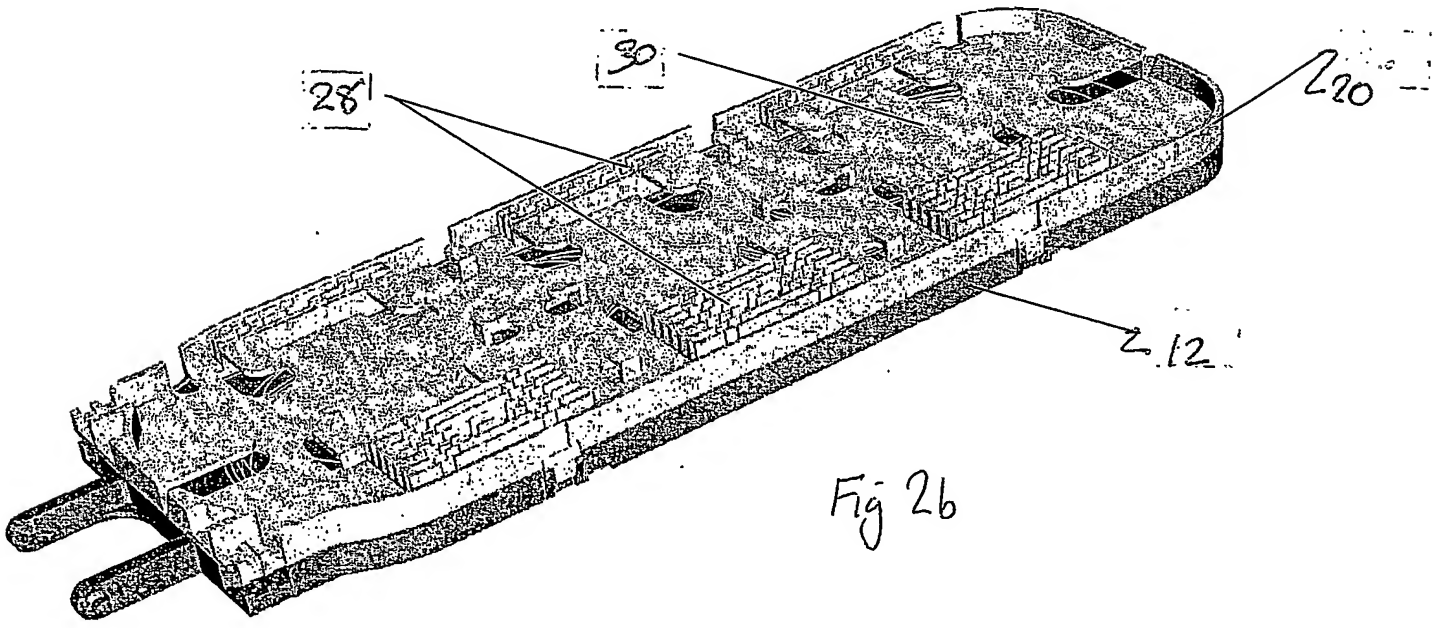

Fig 2b

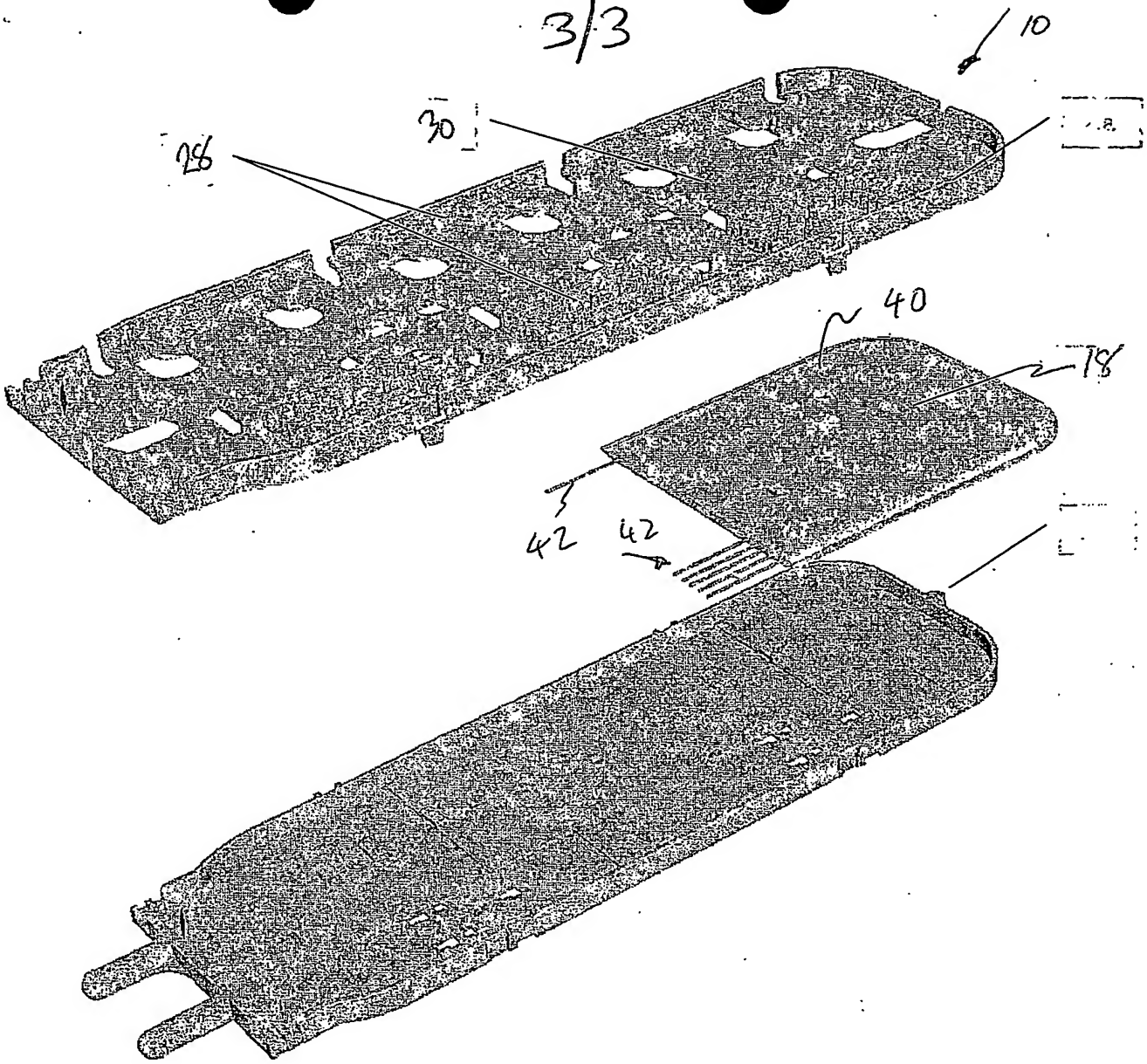

Fig 3